

What is claimed is:

1 1. A computer assisted method comprising:
2 measuring activity of one or more internal voxels of a brain;
3 employing computer executable logic that takes the measured brain activity and
4 determines one or more members of the group consisting of: a) what next stimulus to
5 communicate to the subject, b) what next behavior to instruct the subject to perform, c)
6 when a subject is to be exposed to a next stimulus, d) when the subject is to perform a
7 next behavior, e) one or more activity metrics computed from the measured activity, f)
8 a spatial pattern computed from the measured activity, g) a location of a region of
9 interest computed from the measured activity, h) performance targets that a subject is
10 to achieve computed from the measured activity, i) a performance measure of a
11 subject's success computed from the measured activity, j) a subject's position relative
12 to an activity measurement instrument; and
13 communicating information based on the determinations to the subject in
14 substantially real time relative to when the activity is measured.

1 2. A method according to claim 1 wherein measuring brain activity is performed
2 by fMRI.

1 3. A method according to claim 1 wherein the determinations are made in less than
2 10 seconds relative to when the activity is measured.

1 4. A method according to claim 1 wherein the determinations are made in less than
2 1 second relative to when the activity is measured.

1 5. A method according to claim 1 wherein the determinations are made in less than
2 0.5 second relative to when the activity is measured.

1 6. A method according to claim 1 wherein the information is determined while the
2 instrument used for measurement remains positioned about the subject.

1 7. A method according to claim 1 wherein the activity measurements are made
2 using an apparatus capable of taking measurements from one or more internal voxels
3 without substantial contamination of the measurements by activity from regions
4 intervening between the internal voxels being measured and where the measurement
5 apparatus collects the data.

1 8. A method according to claim 1 wherein measurements are made from at least
2 100 separate internal voxels, and these measurements are made at a rate of at least once
3 every five seconds.

1 9. A method according to claim 1 wherein measurements are made from a set of
2 separate internal voxels corresponding to a scan volume including the entire brain.

1 10. A method according to claim 1 wherein the size of the internal voxels have a
2 total three dimensional volume of 5x5x5cm or less.

1 11. A method according to claim 1 wherein the size of the internal voxels have a
2 total three dimensional volume of 1x1x1cm or less.

1 12. A method according to claim 1 wherein the method further comprises selecting
2 one or more of the internal voxels to correspond to a region of interest for the subject
3 and using the selected internal voxels of the region of interest to make the one or more
4 determinations.

1 13. A method according to claim 12 wherein the region of interest is selected from
2 the group consisting of the regions listed in Figure 14, including the substantia nigra,
3 subthalamic nucleus, nucleus accumbens, locus coeruleus, periaqueductal gray matter,

4 nucleus raphe dorsalis, nucleus basalis of Meynert, dorsolateral pre-frontal cortex,
5 anterior pre-frontal cortex.

1 14. A method according to claim 12 wherein the region of interest has a primary
2 function of releasing a neuromodulatory substance, where the neuromodulatory
3 substance is selected from the group consisting of: dopamine, acetyl choline,
4 noradrenaline, serotonin, an endogenous opiate.

1 15. A method according to claim 12 wherein the subject has one or more of the
2 following conditions: Parkinson's disease, Alzheimer's disease, attention & attention
3 deficit disorder, depression, substance abuse & addiction, schizophrenia.

1 16. A method according to claim 1 wherein the information is communicated by a
2 manner selected from the group consisting of providing audio to the subject, providing
3 tactile stimuli to the subject, providing a smell to the subject, displaying an image to the
4 subject.

1 17. A method according to claim 1 wherein the information communicated is an
2 instruction to the subject.

1 18. A method according to claim 17 wherein the instruction is a text or iconic
2 indication denoting an action that a subject is to perform.

1 19. A method according to claim 17 wherein the instruction identifies a task to be
2 performed by the subject.

1 20. A method according to claim 17 wherein the instruction is determined by
2 computer executable logic.

1 21. A method according to claim 20 wherein the instruction communicated is
2 selected from a set of instructions stored in memory, the selection being based upon the
3 brain activity measured.

1 22. A method according to claim 1 wherein some of the information communicated
2 to the subject is material to be learned.

1 23. Computer executable software for guiding brain activity training comprising:
2 logic which takes data corresponding to activity measurements of one or more
3 internal voxels of a brain and determines one or more members of the group consisting
4 of: a) what next stimulus to communicate to the subject, b) what next behavior to
5 instruct the subject to perform, c) when a subject is to be exposed to a next stimulus, d)
6 when the subject is to perform a next behavior, e) one or more activity metrics
7 computed from the measured activity, f) a spatial pattern computed from the measured
8 activity, g) a location of a region of interest computed from the measured activity, h)
9 performance targets that a subject is to achieve computed from the measured activity,
10 i) a performance measure of a subject's success computed from the measured activity,
11 j) a subject's position relative to an activity measurement instrument; and
12 logic for communicating information based on the determinations to the subject
13 in substantially real time relative to when the activity is measured.

1 24. Software according to claim 23 wherein the software performs the
2 determinations in less than 10 seconds relative to when the brain activity measurement
3 is taken.

1 25. A method comprising:
2 (a) measuring activity of one or more internal voxels of a brain;
3 (b) communicating instructions to a subject derived from that measured activity

4 in substantially real time relative to when the behavior is performed; and
5 (c) having the subject perform a behavior in response to receiving the
6 instructions.

1 26. A method according to claim 25 wherein measuring brain activity is performed
2 by fMRI.

1 27. A method according to claim 25 wherein measurements are made from at least
2 100 separate voxels.

1 28. A method according to claim 25 wherein the instructions are derived through
2 a computer executable logic process of selecting from a set of possible instructions
3 based upon the brain activity measured.

1 29. A method according to claim 29, wherein computer executable logic is employed
2 to cause the information to be communicated to the subject.

1 31. Computer executable software, the software comprising:
2 logic for taking activity measurements of one or more localized brain regions
3 as a behavior is performed; and
4 logic for communicating information to the subject based on the measured brain
5 activity in substantially real time relative to when the behavior is performed;
6 wherein the logic takes new activity measurements as they are received and
7 communicates new information based on the new activity measurements.